Insects on rubber and dogs on springs: Sensing and perturbing moving animals to understand the neuromechanical basis of locomotion

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One of the grand challenges in organismal biology is to understand how the nervous system produces locomotion. Animals move quickly through heterogeneous, three dimensional environments with stability and economy that far surpass our technology. This talk will present work that seeks to discover the control targets used by fast running, legged animals to achieve their remarkable performance. Results from insects and dogs running over soft surfaces will be presented, suggesting that many-legged runners use a different strategy than that of bipedal runners to compensate for soft surfaces. Yet the intriguing possibility exists in both systems that sinking into a surface may simplify the task for the neural controller, because of the mechanics of an altered leg posture on foot touchdown. The implications of these results for finding general principles of locomotor control will be discussed. Finally, exciting future directions enabled by miniaturized sensors and optogenetic techniques will be discussed. These include work in the field to understand the evolutionary origins of gliding, and in the lab to probe mammalian locomotor control circuitry. The integrative nature of this work, drawing on biology, physics, dynamical systems and control theory, as well as robotics, will be highlighted.

References:

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